

What is claimed is:

1 1. A semiconductor device, wherein an interlayer dielectric
2 film having Si-H bonds is provided on a base layer including
3 a semiconductor substrate and a silicon carbon nitride film is
4 formed on said interlayer dielectric film.

1 2. The semiconductor device according to claim 1, wherein an
2 electrically conductive film containing Cu as a main component
3 element is embedded in a trench formed in said interlayer
4 dielectric film and the silicon carbon nitride film is formed
5 on said electrically conductive film.

1 3. The semiconductor device according to claim 2, wherein said
2 interlayer dielectric film and said electrically conductive film
3 are each formed in a plurality of layers and said silicon carbon
4 nitride film is formed so as to cover said electrically conductive
5 film and said interlayer dielectric film each in a top layer.

1 4. The semiconductor device according to claim 1, wherein said
2 silicon carbon nitride film has a nitrogen concentration of not
3 less than 10 atm % but less than 35 atm %.

1 5. The semiconductor device according to claim 2, wherein said
2 silicon carbon nitride film has a nitrogen concentration of not
3 less than 10 atm % but less than 35 atm %.

1 6. The semiconductor device according to claim 1, wherein said
2 silicon carbon nitride film has a nitrogen concentration of not
3 less than 15 atm % but not more than 30 atm %.

1 7. The semiconductor device according to claim 2, wherein said
2 silicon carbon nitride film has a nitrogen concentration of not
3 less than 15 atm % but not more than 30 atm %.

1 8. The semiconductor device according to claim 6, wherein said
2 silicon carbon nitride film contains not less than 22 atm % but
3 not more than 27 atm % Si, not less than 20 atm % but not more
4 than 25 atm % C, and not less than 35 atm % but not more than
5 45 atm % H.

1 9. The semiconductor device according to claim 7, wherein said
2 silicon carbon nitride film contains not less than 22 atm % but
3 not more than 27 atm % Si, not less than 20 atm % but not more
4 than 25 atm % C, and not less than 35 atm % but not more than
5 45 atm % H.

1 10. The semiconductor device according to claim 4, wherein said
2 silicon carbon nitride film further contains not less than 0.5
3 atm % but less than 5 atm % O.

1 11. The semiconductor device according to claim 5, wherein said
2 silicon carbon nitride film further contains not less than 0.5
3 atm % but less than 5 atm % O.

1 12. The semiconductor device according to claim 1, wherein said
2 interlayer dielectric film having Si-H bonds is a ladder-type
3 hydrogenated polysiloxane film or a porous ladder-type
4 hydrogenated polysiloxane film.

1 13. The semiconductor device according to claim 2, wherein said
2 interlayer dielectric film having Si-H bonds is a ladder-type
3 hydrogenated polysiloxane film or a porous ladder-type
4 hydrogenated polysiloxane film.

1 14. The semiconductor device according to claim 2, wherein a
2 metal nitride film is provided between said interlayer dielectric
3 film and said electrically conductive film containing said Cu
4 as a main component element and a metal film is provided between
5 said electrically conductive film containing said Cu as a main
6 component element and said metal nitride film.

1 15. The semiconductor device according to claim 2, wherein said
2 electrically conductive film containing Cu as a main component
3 element is a Cu alloy film containing at least one kind selected
4 from the group consisting of Al, Si, Ag, W, Mg, Bi, Zn, Pd, Cd,
5 Au, Hg, Be, Pt, Zr, Ti and Sn.

1 16. The semiconductor device according to claim 2, wherein said
2 electrically conductive film containing Cu as a main component
3 element is a Cu alloy film containing Si and the Si content is
4 highest on a top surface of the electrically conductive film

5 and gradually decreases with increasing depth in the direction
6 of a bottom surface.

1 17. A fabricating method of a semiconductor device, comprising:
2 a first step of forming an interlayer dielectric film having
3 Si-H bonds on a semiconductor substrate;
4 a second step of forming a trench in said interlayer
5 dielectric film;
6 a third step of forming a barrier metal film on a side wall
7 and bottom surface of said trench;
8 a fourth step of embedding an electrically conductive film
9 containing Cu as a main component element in a trench in which
10 said barrier metal film is formed; and
11 a fifth step of forming a silicon carbon nitride film on
12 said interlayer dielectric film and said electrically conductive
13 film.

1 18. The fabricating method of a semiconductor device according
2 to claim 17, wherein said third step involves forming a barrier
3 metal film which is formed by sequentially laminating a metal
4 nitride film and a metal film on a side wall and bottom surface
5 of said trench.

1 19. The fabricating method of a semiconductor device according
2 to claim 17, wherein said electrically conductive film containing
3 Cu as a main component element is a Si-containing film in which
4 a Cu film is subjected to silane treatment.

1 20. A semiconductor device, wherein an interlayer dielectric
2 film having Si-H bonds and an electrically conductive film
3 containing Cu as a main component element are provided on a base
4 layer including a semiconductor substrate, a metal nitride film
5 is provided between said interlayer dielectric film and said
6 electrically conductive film containing Cu as a main component
7 element, and a metal film is provided between said electrically
8 conductive film containing Cu as a main component element and
9 said metal nitride film.

1 21. The semiconductor device according to claim 20, wherein
2 said electrically conductive film containing Cu as a main
3 component element is buried in a trench formed in said interlayer
4 dielectric film.

1 22. The semiconductor device according to claim 20, wherein
2 said metal film is Ta and said metal nitride film is TaN.

1 23. The semiconductor device according to claim 22, wherein
2 said TaN has a nitrogen content of not less than 15 atm %.

1 24. The semiconductor device according to claim 22, wherein
2 said TaN has a nitrogen content of not less than 15 atm % but
3 less than 40 atm %.

1 25. The semiconductor device according to claim 20, wherein
2 said interlayer dielectric film having Si-H bonds is either a

3 hydrogenated polysiloxane film or a hydrogenated
4 organopolysiloxane film.

1 26. The semiconductor device according to claim 25, wherein
2 said hydrogenated polysiloxane film is a ladder-type
3 hydrogenated polysiloxane film or a porous ladder-type
4 hydrogenated polysiloxane film.

1 27. The semiconductor device according to claim 20, wherein
2 said electrically conductive film containing Cu as a main
3 component element is a Cu alloy film containing at least one
4 kind selected from the group consisting of Al, Si, Ag, W, Mg,
5 Bi, Zn, Pd, Cd, Au, Hg, Be, Pt, Zr, Ti and Sn.

1 28. The semiconductor device according to claim 20, wherein
2 said electrically conductive film containing Cu as a main
3 component element is a Cu alloy film containing Si and the Si
4 content is highest on a top surface of the electrically conductive
5 film and gradually decreases with increasing depth in the
6 direction of a bottom surface.

1 29. A fabricating method of a semiconductor device, comprising:
2 a first step of forming an interlayer dielectric film having
3 Si-H bonds on a semiconductor substrate;
4 a second step of forming a trench in said interlayer
5 dielectric film;

6 a third step of forming a barrier metal film which is formed
7 by sequentially laminating a metal nitride film and a metal film
8 on a side wall and bottom surface of said trench; and
9 a fourth step of embedding an electrically conductive film
10 containing Cu as a main component element in a trench in which
11 said barrier metal film is formed.

1 30. The fabricating method of a semiconductor device according
2 to claim 29, wherein said electrically conductive film containing
3 Cu as a main component element is an Si-containing film in which
4 a Cu film is subjected to silane treatment.

1 31. The fabricating method of a semiconductor device according
2 to claim 29, wherein said first step is a step in which after
3 the formation of an interlayer dielectric film containing Si
4 as a main component element, hydrogen is caused to diffuse to
5 said interlayer dielectric film thereby to form the Si-H bond.

1 32. The fabricating method of a semiconductor device according
2 to claim 31, wherein said diffusion treatment of hydrogen is
3 any of plasma treatment, electron beam treatment, radical
4 treatment and ion implantation treatment.